

Type specimens of bryophytes in Australian herbaria

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Abstract

A brief history of bryophyte taxonomy in Australia and the status of bryophyte collections in Australian herbaria is given. Most Australian species described prior to the 1960s were named by researchers in Europe and the type specimens retained there. Thus only isotypes were retained in Australia. Holotypes were rarely designated by bryologists and often many syntypes are listed in the protologue. Among collections are many putative type specimens. As these are of particular importance to monographers and location of types is often difficult and time consuming, we have traced specimens designated as types or *nov. sp.* in Australian herbaria, located literature, and designated the status of the type, after communication with overseas herbaria where the author of the type description worked. Label data for each specimen is being stored in a database file (dBase III) for continued access and analysis. The most recent information on the status of the basionym is included together with suggested action if lectotypification is required. The results will appear in a series of separate publications.

In this Bicentennial year when we are surveying our history and heritage, it is appropriate to consider how much or how little we know about our flora, not only vascular plants, including flowering plants and ferns, but those less obvious but equally important cryptogams, the bryophytes, lichens and algae. Only bryophytes are discussed here.

History of Bryological studies in Australia

Very few collections of bryophytes (mosses, liverworts and hornworts) were made in Australia in the early to mid-1800s but those of botanists such as J. D. Hooker (Tasmania and Antarctica), J. Drummond & L. Preiss (Western Australia) are important (Scott & Stone 1976, Catcheside 1980).

In the second half of the nineteenth century, however, resident botanists working on local floras added a considerable number of specimens to Australian herbaria (Willis 1949). These botanists included Ferdinand Mueller (Victoria and eastern Australia); Sullivan, Bastow (Victoria); Bastow, Weymouth, Rodway (Tasmania); Forsyth, Whitelegge, Watts (New South Wales); Bailey, Watts, Wild (Queensland). By exchange, correspondence, and publication of new species they highlighted to the rest of the world the uniqueness of our bryoflora (refer to bibliography in Scott & Stone 1976).

The research and description of these was carried out largely by European botanists (e.g. C. Müller 1897, 1898, 1901). The first attempt to produce a complete list of Australian mosses was undertaken by Edward Hampe (1880) at 85 years of age. He systematically arranged the names known to him from mainland Australia. The list was mainly based on his own collections and those of the British bryologist, William Mitten. Ferdinand Mueller (1882) completed this list, adding species from Western Australia and Tasmania, and

incorporating information provided by Mitten while Forsyth (1900) increased the known species from New South Wales by 43. Preliminary studies on hepatics were published by Stephani and Watts (1914). Mitten (1856) published a list of F. Mueller's collections of both mosses and hepatics in Victoria and it is one of the earliest lists. All this information was drawn together in monumental works on *Musei* by Brotherus (vol 10 & 11) and *Hepaticae* by Schiffner (vol 9) in Engler & Prantl's, *Die natürlichen Pflanzenfamilien* (1924–5) where names of species and their geographical location are given (in German) with some keys and clues to important characters. To extract from this is both tedious and unsatisfactory as a number of names may occur grouped together with the same set of key characters without any means of differentiating between them. Thus the only method for true identification has been to obtain the type description from literature, then check the type specimen of all those species considered closely related.

The next attempt to catalogue the mosses of Australia was that of Watts & Whitelegge (1902, 1905) who produced part of a Census of Australian mosses, later completed by Burges (1932, 1935). Only scattered publications relating to Australian species appeared between 1915 and 1960, primarily those of Burges (1932, 1935) and Willis, between 1952 and 1958, who presented a centennial review of studies in Victoria in 1955. Until the publication of Scott & Stone's (1976) *Mosses of southern Australia* we had to rely on Rodway's (1914, 1916) *Tasmanian bryophyta*, early scattered papers of C. Müller, Brotherus & Watts, Willis, Forsyth and overseas researchers on Australian mosses, and to Sainsbury's (1955) *Handbook of New Zealand mosses. The mosses of South Australia* (Catcheside 1980) added valuable information on some arid zone species. All these dealt almost exclu-

NSW

AUS

EPHEMERELLA *readeri* C. Muell.

Vic.

Loc.: Basin of old Sheep Wash,
Upper Region Station Vic.

Coll.: F. M. Reader 3.1x.1894
Watts Vic 8

≡ *Physcomitrium readeri* (C. Muell.) Roth.

C. Müller: *Symbolae ad Bryologiam Australiae III*
Hedwigia 41:120 (1902)

303. *Ephemerella* (*Physcomitridium*) *Readeri* n. sp.; dioica, robusta caulescens sed perbrevis simplex late gregarie cespitosa viridissima; inferne tenuis nuda apicem versus foliis nonnullis paucis magnis erectis imbricatis mollibus oblecta; folia e basi brevissima angustiore in laminam late cochleariformi-ovatam acumine brevissimo obtusiusculo terminatam producta, margine erecto superne cellulis protuberantibus breviter obtusato-serrata, nervo obsolete laxissime reticulato mediano lenissime exarata, e cellulis magnis laxis amplis mollibus reticulata; theca in pedicello perbrevis crassiusculo molli flavido immersa majuscula globosa oblique rostellata virescens mollis, calyptra distincte dimidiata stylifera operculum solum obtegente pallidissima tenuiter membranacea; sporae permultae magnae aureae.

Habitatio. Australia, Victoria, Dimboola. solo humido, Septembri 1897: Fr. Reader, qui 1898 ex Dimboola communicavit.

Species maxime memorabilis, inter *Ephemerellas* locum tenens, ut *Ephemerum patens* inter *Ephemerata*, habitu physcomitriaceo.

Fig. 1. Card index format. Front of card above, back of card below.

TAXON: Basionym.

REF: Reference for basionym.

LABEL: Specimen label data. When there are several specimens each individual variation is entered. Latitude and longitude may be given here as additional information.

PROTO: Protologue - geographical location of type collection.

AUSTR: Australian herbarium, status of type and actual collectors numbers held in each.

NON: Other herbaria holding type specimens, status of type and collectors numbers held there where known.

REC: Remarks including present name if different, reference to recent treatment, action required e.g. need to choose lectotype etc.

Fig. 2. Format for entry of data into dBase III.

sively with temperate taxa and virtually nothing was or is yet available on tropical and subtropical species. Scott (1982) pointed out that Australia consisted of two phytogeographical regions, temperate and tropical, and emphasized the need for extensive studies in the tropical regions. In particular he stressed the paucity of information on hepatics as no flora, even for a single region, had been produced up to that time. This

has been redressed since then, largely for the temperate areas, by Scott with two publications — a checklist of Australian liverworts (Scott & Bradshaw 1986) and *Southern Australian liverworts* (Scott 1985).

There is still no overall flora available for subtropical and tropical species but publications, scattered in recent literature, by Stone (e.g. 1976, 1977, 1983a & b, 1984, 1985) and Stone and others between 1961 and

1988 (many papers) have added many new and important taxa. In Australia as a whole the activity of researchers such as Scppelt (1982a & b) Lewinsky (1984), Vitt & Ramsay (1985), Catcheside (1987), Reese & Stone (1987), Frahm (1987) and others on mosses and by Hewson (1970a & b), Na-Thalang (1980), Scott (1985, 1987), Scott & Pike (1984, 1987a & b), Theirs (1987), Windolf (1987), Hattori (1979a & b, 1984, 1987), Ratkowsky (1987) on liverworts, to mention a few summary papers, are increasing our knowledge. More complete reference lists for recent publications can be found in Ramsay (1984) and Ramsay & Selkirk (1985–1988). It is true to say that from studies that have been undertaken to date that the moss and hepatic flora in Australia is extensive and new taxa are being discovered at all levels with careful and continuous collecting.

Since 1982 there has been an even greater explosion of knowledge, as the collections and publications of those mentioned above and others indicate. The publication by Streimann & Curnow (in press) cataloguing all Australian mosses in literature, together with a complete bibliography, will soon give us a true estimate of our present knowledge and become a most valuable guide for future investigations.

Bryophyte collections in Australian herbaria

The major herbaria in Australia all have some bryophyte collections which, until the last ten years, had received little taxonomic attention. They have usually been poorly curated, except for those in National Herbarium of Victoria (MEL) where J. H. Willis was working. For example, specimens at the National Herbarium of New South Wales, such as those of W. W. Watts, were in old folded packets made from church newspapers, their original paper wrapping, and largely unsorted. Collections in all Australian herbaria are now packaged and sorted although there are substantial numbers not yet identified. Few herbaria have a trained bryologist on the staff. Overseas monographers such as Vitt, Lewinsky, Reese and Touw have contributed in recent years by correctly naming collections from many Australian herbaria. The numbers of specimens available for study has been increased also by Australian workers investigating bryologically rich but previously uncollected geographical and ecological areas such as north Queensland rainforest, the Northern Territory, arid regions of South and central Australia, south-western Western Australia and the Kimberleys. Additional and important new specimens have been added from other areas. There has been valuable research input also from overseas visitors and those who have studied here.

The present estimate of the size of the bryophyte collections available for study in Australia is given in Table I, the data having been extracted and updated from Vitt *et al.* (1985). In addition there are some substantial private collections for which no data are available.

Collections at NSW

The bryophyte collection at NSW, with which we are most familiar, was until recently the largest held in any Australian herbarium (Table I). The bulk of it, containing large collections by Forsyth, Whitelegge and Watts, was accumulated in the late 1800s and early

Table I
Estimated size of bryophyte collections in Australian herbaria*

Herb.	Mosses	Types	Liverworts	Types
AD	4,000	?	1,000	?
BRI	6,113	90	1,026	15
CANB	5,900	54	1,500	8
CBG	40,284	12	14,400	12
HO	13,000	20	6,000	160
MEL	30,000	c. 200	3,700	?
MELU	16,000	c. 20	300	?
MUCV	2,500	—	2,500	10
PERTH	2,000	10	?	?
NSW	39,300	775**	6,000	90
SYD	1,800	1	2,284	—
UNSW	8,000	—	200	—
UWA	1,500	?	?	?
Total	170,397	1,164	38,910	295

Published names for Australian mosses c. 4,000

Presently accepted names c. 1,300

* from data available at 17 Dec. 1988

** Exotic species 460, Australian species 315

? = no information obtained

— = no types present

this century, making it of historical importance. It is this collection to which we refer in detail. The number of type collections, formerly estimated as at least 200 (Ramsay & Briggs 1979), has been found to be much larger (Table I), and contains types of Australian mosses and liverworts, a large number of types of exotic mosses sent on exchange to W. W. Watts early this century (Ramsay 1980) and some important types of liverworts collected in the 1960s by Hewson and Na Thalang. In fact, the bulk of bryophyte types held in Australia are housed here.

Type specimens of bryophytes

Correct names for bryophytes are dependent on correctly published type descriptions in the same way as they are for vascular plants. The type specimen thus represents the historical basis for the taxonomic name and is vital for any reassessment of the taxon with time. For moss taxa the starting point for the valid publication of names is 1801 (Hedwig's *Species Muscorum*) and for hepatics it is 1753 (Linnaeus's *Species Plantarum*). The publication of *Index Muscorum* (Wijk *et al.* 1959–1969) and supplements (Crosby 1977, 1978; Crosby & Bauer 1981, 1983, 1987; Bauer & Crosby 1985) and *Index Hepaticarum* (Bonner 1962–1978) and supplements (Engel 1984) provide a ready source of published names and synonyms.

In the absence of specialist bryologists in Australia until the mid 1900s specimens were sent to Europe for naming by W. Mitten, C. Müller, V. F. Brotherus, F. Stephani and H. N. Dixon. This meant that in the past, type specimens were retained by the authors of the names and description and are still located overseas. Some duplicates, isotypes and syntypes, were retained in Australia. Holotypes of more recently described taxa are now retained in Australia.

Preparation of register of type specimens

The necessity for referral to type specimens for monographic revisions is well understood and locating such specimens can be time consuming. A specimen-based approach or the production of a type register locates putative types in herbaria. This is followed by a literature search to confirm the status of each specimen.

Bryum aequicollum Broth. & Watts
Proc. Linn. Soc. New South Wales 40: 372 (1915)

Label

1. Second open gully, S. of King's, LHI, W. W. Watts 213a, 15.viii.1911.
2. Mt Gower, LHI, W. W. Watts 360, 1-4.viii.1911.
3. Open gully just S of King's, LHI, W. W. Watts 147d.
4. Rocks S. of King's, LHI, W. W. Watts 207, 15.vii.1911.
5. Mt. Gower, LHI, W. W. Watts 408, 1-4.viii.1911.

Proto

"Among rocks one mile south of King's (n 207); open gully south of King's (n 147d, 213a); Mt Gower (n 360, 408); also Northern Hills and sea cliff, Middle Beach."

ISOSYN: NSW (Watts 147d, 207, 213a, 360, 408)

SYN: H-BR. (Watts 147d, 207, 213a, 360, 408)

Rec

[= *B. dichotomum* Hedw., based on specimens cited by Ochi (1970: 17): Watts 147d, 213a, 360 from H. Not lectotypified by Ochi.]

* * *

Macromitrium subbrevicaule Broth. & Watts
Proc. Linn. Soc. New South Wales 40: 371 (1915)

Label

1. North Head, LHI, W. W. Watts 478 viii.1911
2. North Head, LHI, W. W. Watts 507 viii.1911
3. Northern Hills, LHI, W. W. Watts 239 21.vii.1911
4. North Head, LHI, W. W. Watts 504 viii.1911
5. Top of Northern Hills, LHI, W. W. Watts 236 21.vii.1911
6. Seacliff, top of Northern Hills, LHI, W. W. Watts 21.vii.1911

Proto

'Growing mostly on cliffs at North Head and on the Northern Hills (n 236, 239, 478, 504, 507).'

ISOLECTO: NSW (Watts 239); SYN: NSW (Watts 236, 478, 504, 507)

LECTO: H-BR. (Watts 239) Vitt & Ramsay, 1985; SYN: H-BR.

Rec

[= *M. brevicaule* (Besch.) Broth. Vitt & Ramsay, (1985: 381-382) Specimen 6 above without collection number is annotated probably an Isotype, data match protologue D. H. Vitt Nov. 6 1984]

Fig. 3. Examples of computer printout.

Early bryologists rarely designated holotypes, often naming a series of specimens in the protologue (syntypes). This necessitates choosing a lectotype when carrying out a revision, a procedure which must be done carefully to avoid future nomenclatural problems.

In this project we have traced type specimens of Australian mosses in all Australian herbaria, located relevant literature and are in the process of storing the data in a database program (dBase III) for continued access and analysis. The aim is to compile a register of type specimens held in Australian herbaria.

All label data have been collected from putative type specimens onto index cards (Fig. 1). The data are then extracted and assembled into dBase III using the format as set out in Fig. 2. Label data are then compared

with the protologue to confirm it is a type. We have included the abbreviation for each herbarium holding types in Australia and sought information from the overseas herbarium likely to have the original specimen on which the protologue was based. The resultant data printout is given as Fig. 3.

This kind of register (Ramsay *et al.*, in press), whilst extremely time consuming to produce, has been of great value in helping to find and define type specimens available for study in Australia. At NSW the type collection has been extracted from the main collection for assessment. All specimens with 'type' written on them and all with *nov. sp.* have been set aside for checking. The literature search has quickly indicated those which are *nomina nuda*. From the protologue it has been possible to find types, additional to those ori-

ginally detected, by checking in the main collection for the collector's numbers given in the protologue. The card index system provides a permanent record of the specimen data and the literature.

The advantages of this kind of register can be summarized as follows:

1. rapid accessibility to location of type specimens;
2. up to date information on recent revisions;
3. data management for many forms of request, including print outs of all taxa in a particular genus or herbarium;
4. continuing capacity to update as new species are described or new synonymies made;
5. time saving facility enabling data search without need to handle fragile specimens.

Results of the studies will appear as a series of multi-authored publications including Australian mosses, special collections at NSW, exotic species, hepatic types at NSW and Carl Müller specimens at NSW.

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